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Distribution of Army Cutworm Larvae in Wheat and Barley Fields[1]

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Abstract
Populations of the army cutworm, *Chorizagrotis auxiliaris* (Grote), tended to be higher in winter barley than winter wheat planted side by side in the same field. Highest populations occurred in barley within 30 feet of the adjoining wheat. Distribution of larvae in linear 1-foot samples agreed closely with the Poisson. Practical application of these results are discussed.

The army cutworm, *Chorizagrotis auxiliaris* (Grote), is an important pest of wheat, barley, alfalfa, and other crops in Nebraska. Winter barley, because of wheat acreage allotments, is becoming of increasing importance in western Nebraska and has been especially susceptible to cutworm injury. Whether this susceptibility to injury might be caused by higher cutworm populations, as reported by farmers, seemed worthy of investigation.

Methods

Six comparisons of larval populations were made in 1959 using paired winter wheat and barley fields on the same farms in Keith County. Fields were selected which had received similar cultural practices and were seeded about the same time. In no case was there any barrier between the paired fields with a maximum of 2 feet of cultivated ground separating the two. Sampling was begun 100 feet into each field from the adjoining road and continued at 10-foot intervals for another 90 feet parallel to the common boundaries. Paired samples were taken at distances of 3, 10, 20, 30, 50, and 100 feet into each crop perpendicular to the common boundary. One linear foot of soil was examined on each side of the row nearest these measured distances. The width of these sample units varied from 8 to 12 inches, depending on row spacing, but always included the entire distance to the next row.

Row spacing was the same in each pair of fields sampled, and all rows ran parallel to the common border. This sampling procedure, while not allowing actual comparisons of populations between different pairs of fields without adjusting for sample width, clearly defined differences between wheat and barley in each pair of fields. Linear-foot counts were transformed by $\sqrt{x} + 1$ prior to analysis and Duncan's (1955) Multiple Range Test was used to make comparisons.

Results

Comparisons of populations at different distances into paired wheat and barley fields from the common boundary are given in Table 1. These results are presented graphically in Figure 1 in terms of actual populations rather than transformed values.

Table 1. Mean number of army cutworm larvae per linear foot of row at different distances from the common boundary in six paired wheat and barley fields[a]

	Field[b]					
Feet into Field	1	2	3	4	5	6
Wheat						
100	1.27 cdef	1.28 abc	1.14 de	1.46 e	1.39 cd	1.52 abc
50	1.21 def	1.18 bed	1.18 cd	1.59 bcde	1.40 cd	1.55 abc
30	1.16 efg	1.12 cd	1.18 cd	1.52 de	1.63 abc	1.69 ab
20	1.09 fg	1.l2 cd	1.12 de	1.62 bcde	1.61 bc	1.79 a
10	1.04 g	1.20 bcd	1.02 f	1.55 cde	1.71 ab	1.38 cd
3	1.04 g	1.08 d	1.06 ef	1.75 abcd	1.31 d	1.48 bcd
Barley						
3	1.35 bcd	1.39 a	1.53	1.67 bcde	1.55 bcd	1.60 abc
10	1.40 abc	1.35 ab	1.32 ab	1.76 abcd	1.64 abc	1.65 abc
20	1.52 a	1.38 a	1.36 a	1.84 ab	1.78 ab	1.46 bcd
30	1.29 bcde	1.27 abc	1.28 ab	1.96 a	1.89 a	1.54 abc
50	1.32 bcde	1.31 ab	1.26 bc	1.82 abc	1.62 bc	1.49 bcd
100	1.44 ab	1.29 abc	1.32 ab	1.79 abcd	1.54 bcd	1. 22 d

a. Data transformed by $\sqrt{x} + 1$.

b. Any two means in the same column not followed by the same letter are significantly different at the 5% level.

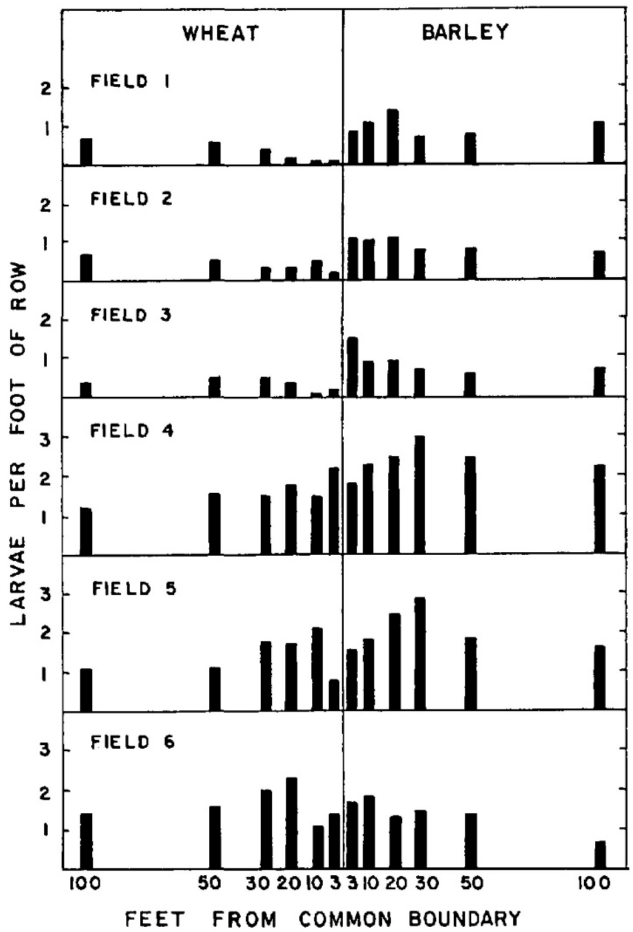

Figure 1. Army cutworm populations in six paired wheat-barley fields at different distances from the common boundaries.

Significantly higher populations were found in barley than in wheat in five of the six paired fields. In Field 6 wheat had slightly but not significantly more cutworms than barley. Greatest fluctuations in cutworm populations occurred within 30 feet of the common boundary. In no case was there a significant difference between samples taken at 50 and 100 feet into either crop from this common border, and counts made at these distances likely were more representative of the field as a whole. Using only samples taken at 50 and 100 feet as a basis for comparing the two crops, barley was still found to have significantly higher populations in four fields with no difference in two.

Samples taken across wheat and barley parallel to the common boundary showed significant differences to exist in that direction only in Field 3. In this field there were more cutworms in both wheat and barley in the first 50 feet nearer the road. Heavier marginal infestations have been observed to occur commonly in both crops. Sampling areas in this study were purposely located 100 feet away from adjoining roads to avoid such variation, leaving only the effect of the wheat-barley boundary to explain.

Although varying in distance and intensity, the most notable feature revealed by these samples was a peak population in barley within 30 feet of the common boundary. This effect was noted in five of the six fields. Also in all but Field 4 this peak was accompanied by lower counts in wheat within 20 feet of the boundary. These peaks and depressions always fell within about 30 feet of each other. It would appear that winter barley, under identical cultural practices, had higher cutworm populations than wheat and that the factor responsible was operating most strongly along the boundary between the two crops. This effect was most marked in fields that had lower populations. Although the reasons for this larval distribution are unknown, certain practical uses may be made of this information without knowledge of its causes.

Practical Application of Results

When making surveys for the army cutworm, it would appear highly desirable that samples be taken 50 to 100 feet or more away from any road or adjoining field. As shown, samples taken within 30 feet of the field edge may give highly misleading estimates of the population occurring over the field as a whole. Stratified random samples, when economically feasible, would be even more appropriate. Such a sampling procedure should certainly be used when determining the need for control measures. It seems likely that in many cases only the more heavily infested border of a field would warrant treatment.

In research work, the design of the experiment should take into consideration these marginal changes in population. If uniform infestations are desired, location of plots as near the center of a field as possible would be indicated. If field margins are to be used for convenience or to obtain higher infestations, it would seem advisable to place blocks of plots parallel to these margins. Field corners, in which variation would be expected to occur in two directions, should be avoided, if possible, or a design such as a latin square used that will permit easy removal of both row and column effects.

Mathematical Distribution of Larvae

Larval counts in linear 1-foot samples in all fields studied agreed closely with the Poisson distribution. Table 2 gives the observed and theoretical distributions for one pair of fields. Counts in other fields fitted the Poisson equally well.

Table 2. Frequency distribution of army cutworm larvae in linear 1-foot samples and comparison with Poisson distribution

	Field II—Wheat		Field II—Barley	
Larvae per foot	Observed Frequency	Expected Frequency	Observed Frequency	Expected Frequency
0	28	29.1	17	16.7
1	40	41.2	37	32.9
2	33	29.2	29	32.5
3	14	13.8	20	21.4
4	3	4.9	8	10.6
5	2	1.4	5	4.2
6+	0	0.4	4	1.7
Total	120	120.0	120	120.0
	$\chi^2 = 0.99$ P = > 0.90		$\chi^2 = 3.26$ P = > 0.65	

A square root transformation suggested by Snedecor (1956) for low counts agreeing with the Poisson was used in this study to gain precision. However, when several samples are pooled and totals analyzed, as is commonly done in chemical control studies, the use of a transformation will not ordinarily lead to conclusions any different from those reached by an analysis of the original data.

Note

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